One Distinction

The Language of the Sciences Rewritten to Fit the Minimal Definition of the Vacuum.Net Theory

J. Konstapel

Constable Research, Leiden

First Editionv3

— 27 November 2026

“A distinction is a movement that returns to itself. The distinction is at once the first mark.”

© 2026 J. Konstapel, Constable Research, Leiden. All rights reserved. Quotation with attribution is permitted; reproduction of the whole requires written permission.

Contents

About this book
1. The minimal definition
2. Method
3. The translation key
4. Mathematics and logic
5. Physics
6. Chemistry
7. Earth and climate science
8. Biology
9. Medicine
10. Psychology and cognitive science
11. Linguistics
12. Computing and information science
13. Economics
14. Social sciences
15. Depths
16. What recurs
Appendix A. The 58 assumptions and their transformation
Appendix B. Status of the statements
Annotated References

About this book

This book asks one question. Which language in the sciences must change so that it fits one minimal definition?

The definition is: a distinction is a movement that returns to itself. The distinction is at once the first mark.

The book does not prove the sciences wrong. It does not predict anything. It shows, field by field, which words carry assumptions that the definition does not need. For each word it gives a translation into the language of the definition.

Every translation in this book is a reading. A reading is a correspondence, not a proof. Appendix B defines the statuses. A reader may reject any line. The argument should then be about that line.

The book rests on the definition alone. It uses a small set of mathematical results, listed in Section 1.5. Each is standard mathematics and is proved without any further assumption about the world. The book also uses The Assumptions Nobody Declares (July 2026), which lists 58 assumptions of modern science. Numbers in square brackets, such as [29], refer to that list.

1. The minimal definition

A distinction is a movement that returns to itself. The distinction is at once the first mark.

There is one primitive: the distinction. Movement, loop and mark are three sides of it. Movement is the going. Loop is the return. Mark is the sign that the return makes.

1.1 What follows from it

- Three states. A movement along a loop goes with the loop, against it, or not at all. These are +1, −1 and 0: the trinity.
- Sum zero. Going with and then against cancels. The three states sum to zero.
- The window of three. The shortest movement that goes round has three steps. A window is three steps.
- Closure. What returns, closes. What does not return passes on as tension.
- Winding. Counting the returns gives the winding number. With the loop is +1; against it is −1.
- Depth. A full winding closes and leaves one over. That one is one step of a larger loop. Three windings make one winding one depth higher. Depth is windings in windings.

1.2 What it does not need

- No places given in advance. A place is made by a return.
- No time from outside. A loop without a start counts its own returns.
- No observer from outside. The mark is the observer. Spencer-Brown ends Laws of Form with this identity.
- No constants. What looks constant is a closure that does not vary at the depth read.
- No things that bear properties. A thing is a closure that persists.

1.3 What comes later

Words, a grammatical subject, true and false, and number come after the distinction. They are windings of it. The first sign is in the distinction itself. The full language is not.

This order matters. If the full language were placed in the ground, its assumptions would return with it. The subject [28], the two values true and false [30] and number as primary [3] would then be part of the theory.

1.4 Precedents

Spencer-Brown begins Laws of Form with one instruction: draw a distinction. He ends it by stating that the first distinction, the mark and the observer are identical in the form. His book opens with a line from the Tao Te Ching, chapter 1. In classical Chinese the line can be read as "the nameless is the beginning of heaven and earth" or as "'nothing' names the beginning of heaven and earth". The naming is already in the first line. Chapter 2 says that being and non-being produce each other. Chapter 42 says that two produces three, and three produces all things.

1.5 Mathematical results used

The book uses eight results. They concern words of three-valued steps (+1, 0, −1). They need no assumption about the world, except where a hypothesis is named. Proofs are in standard sources, listed after each result.

No.	Result	Standard source
1	Of the 27 windows of three steps, exactly 9 close (sum divisible by three). They are the windows with all steps equal or all different.	Elementary counting; the rule of three-colouring (Fox).
2	Every closed word reduces completely to standings (0), meetings (x, −x) and rings (x, x, x). No open word does.	Elementary induction.
3	A ring closes in every window exactly when it is a fixed point of the rewrite t(i) → −(t(i−1) + t(i+1)).	Elementary; mod-3 arithmetic.
4	Two different closed windows cannot be joined without at least one open window at the seam.	Elementary; mod-3 arithmetic.
5	Every integer has exactly one balanced-ternary word. Cutting the word is rounding to nearest.	Knuth (1997).
6	Powers of two and of three never meet: 2^n ≠ 3^k. Their best near-meetings are at 1, 2, 5, 12, 41, 53, 306, … powers of three. At 12 the miss is the comma 3^12/2^19.	Hardy and Wright (2008); Khinchin (1964).
7	Hypothesis: a closed path in three-dimensional space. Then the least knot that cannot be undone has three crossings (the trefoil), and it differs from its mirror image.	Reidemeister (1927); Fox and Crowell (1963); Jones (1985).
8	Hypothesis: continuous deformation. Then a winding number cannot change without a cut.	Hopf (1931); homotopy invariance.

These results are also proved in The Vacuum.Net Theory: Foundations, Parts III to VII. Those proofs do not depend on the wording of its Part I.

2. Method

The method has four steps.

- Step 1. Take a field. List the core words that its textbooks use without defining them further.
- Step 2. For each word, name the assumption it carries. Use the numbered list of 58 where possible.
- Step 3. Check the word against the definition. Does the definition need it? If not, the word must be transformed.
- Step 4. Give the transformation: the same content, said in the language of the definition. Mark what stays open.

Three outcomes are possible for each word. It is replaced: the definition offers its own term. It becomes a limiting case: the old word stays valid where a closure does not vary. It is dropped: nothing in the definition corresponds to it.

The book itself uses language. It is written in the third person. Its arguments use true and false. It checks numbers with programs. These are assumptions [24, 26, 30, 43]. They belong to the description, not to the definition. They are declared here so that they are not hidden.

3. The translation key

Most fields share a small set of words. The table gives the general translation. Chapters 4 to 14 apply it per field.

Current word	Assumption	In the language of the definition
Thing, object, particle	[2] [29]	A closure that persists: a movement that keeps returning.
Property	[2]	The way a closure closes: all steps equal (a ring) or all different.
Identity	[29]	The recurrence of the same closure. Sameness is made by return.
Place, location	[7] [8]	A return point. It is made by the return, not given before it.
Space	[7]	The pattern of return points of many distinctions.
Time, instant	[16] [21] [33]	The count of returns. Each distinction carries its own count.
Cause, force	[11] [12]	What does not close and passes on: tension and carry.
Law of nature	[13] [14]	What closes in every window: a fixed point of the rewrite (Result 3).
Constant	[15]	A closure that does not vary at the depth read. A state, not a given.
Equilibrium	[6]	Closure.
Part and whole	[4] [6]	Windings in windings. The whole is the closure of the parts plus the tension at their seams.
Level, scale	[4] [5]	Depth: the number of windings in windings. No bottom is required.
Observer	[18] [34]	The mark itself. A distinction that reads another.
Measurement	[19]	A reading at a stated depth. The reading is itself a distinction.
Random, probable	—	An open window: a path that need not return.
Information	[17]	The address of a closure: its word of three-valued steps.
Number	[3]	Counted windings. It comes after the distinction.
True, false	[30]	Closed, open. A third value: carried to the next depth.
Subject, agent	[28] [57]	None needed. The distinction is the event.

The table is the core of the book. The field chapters show where each line applies and what it changes.

4. Mathematics and logic

Mathematics is the language in which the other sciences write. Its own ground therefore matters most. Modern mathematics rests on sets and on two-valued logic.

4.1 Language in use

Word	Assumption	Transformation
Set, element	[2] [29]	A distinction and what it marks. Spencer-Brown and Kauffman already build from the mark.
Axiom	[47]	Declared ground. The definition is one declared ground; nothing else is assumed.
Excluded middle	[30]	Closed, open, carried. Brouwer rejected the principle for infinite domains in 1908.
Natural number	[3]	Counted windings. Number follows the distinction.
Real continuum	[32]	A reading at a depth. In balanced ternary, cutting is rounding (Result 5).
Binary base	—	Base three. It is the integer radix closest to the optimum and needs no sign or rounding convention.

4.2 What changes

The change is small in practice and large in principle. The proven theorems stay. Their reading changes. A number is no longer a thing. It is a count of returns.

Type theory and the univalent foundations already treat identity as a path. That is close to identity as return [29].

4.3 What stays open

- Whether all of classical analysis can be read at finite depth without loss.
- Whether three-valued closure can serve as the logic of proof, and not only of its objects.

5. Physics

Physics carries most of the world assumptions. Newton made space and time absolute in the Scholium of the Principia. Later physics relativised them but kept them as the stage.

5.1 Language in use

Word	Assumption	Transformation
Absolute space	[7] [8]	Return points. Leibniz and Mach argued for relational space; the definition goes further and makes place a product of return.
Time as parameter	[33] [16]	Counted returns. Each closure keeps its own count. Barbour and Rovelli argue that time is not fundamental.
Particle	[2] [29]	A persistent closure. In space, the least knot that cannot be undone has three crossings (Result 7).
Force, field	[11]	Tension at the seams between closures (Result 4).
Constants of nature	[15]	Closure states at a depth. Smolin argues that laws themselves may evolve.
Conservation by symmetry	[10]	Conservation by topology. A winding cannot change without a cut (Result 8).
Measurement, observer	[18] [19]	A reading at a depth; the reader is a mark.

5.2 What changes

Physics keeps its equations. It loses its stage. Space, time and constants become outcomes of closure, not containers or givens.

Several physicists already moved in this direction: Leibniz, Mach, Wheeler, Barbour, Rovelli and Smolin. None started from a single distinction.

5.3 What stays open

- How the known constants are read as closure states. This belongs to the companion document on physics.
- Whether three-dimensional space, used as a hypothesis in Results 7 and 8, follows from the definition.

6. Chemistry

Chemistry names things: atoms, molecules, bonds. It inherits the physics of particles in space. Primas showed that the molecule with a fixed shape is not deduced from quantum mechanics. It is added.

6.1 Language in use

Word	Assumption	Transformation
Atom, molecule	[2] [29]	Closures at a depth that persist.
Bond	[6]	A shared closure. Two open residues close together.
Valence	—	The open residue of a closure: what it still needs to close.
Reaction	[41]	Reclosure. Old closures open; new ones close; tension passes on.
Molecular shape	[7]	The pattern of return points. Not a position in a given space.
Equilibrium constant	[15]	A closure state that depends on the state of the medium.

6.2 What changes

Chemistry already thinks in balance: charges sum to zero, reactions balance. That fits the sum-zero rule. The change is that the substances are no longer the primary terms. Closures are.

6.3 What stays open

- How the periodic order follows from closure depth. This is open.
- Whether chirality in chemistry is the same asymmetry as the chirality of the first knot.

7. Earth and climate science

Earth sciences work with budgets: energy, water, carbon. A budget assumes a container and an outside cause. Climate science adds forcings, sensitivities and averages.

7.1 Language in use

Word	Assumption	Transformation
System boundary	[52] [7]	A seam between closures. Not a wall in a given space.
Forcing	[11] [12]	Tension from an open window that passes to another depth.
Climate sensitivity	[15]	A state function, not a constant.
Average, mean state	[21]	A reading at a stated depth. The depth must be said.
Cycle, oscillation	—	Winding. Cycles in cycles are windings in windings.
Budget, reservoir	[6]	Closure and carry. What closes stays; what does not close passes on.

7.2 What changes

Earth sciences already know many cycles: tides, seasons, El Niño, ice ages. The definition reads them as windings at different depths. The difference is that no cycle needs an outside driver. Each is a closure, and its residue drives the next depth.

7.3 What stays open

- Which windings and depths must be included to calibrate a climate reading.
- How the near-meetings of the ×2 and ×3 ladders (Result 6) appear in long records.

8. Biology

Biology moved from the organism to the gene. The gene became a unit that carries a program. Critics such as Keller and Noble show that the program has no single location.

8.1 Language in use

Word	Assumption	Transformation
Gene as program	[2] [47]	A closure pattern that persists across generations. Not an instruction from elsewhere.
Organism	[29] [52]	A closure that maintains itself. Maturana and Varela call this autopoiesis; Rosen calls it closure to efficient causation.
Life as chemistry	[40]	A distinct kind of closure: one that closes on its own making.
Natural selection	[41] [12]	Closure selects. What closes persists; nothing selects from outside (Section 1.1).
Species	[58]	A depth of closure in process. Not a finished kind.
Environment	[37]	The closures at the seams of an organism.

8.2 What changes

The definition matches the strongest critics of gene-centred biology. The organism comes back as a closure. Selection comes back as closure, not as an outside judge.

8.3 What stays open

- How the depths of biological organisation map to depths of closure.
- Whether development (the order of closures in an embryo) follows the ladders of two and three.

9. Medicine

Medicine names diseases as entities. It measures patients against reference ranges. Canguilhem showed that the normal is not a fact found in nature. It is a norm set by the living.

9.1 Language in use

Word	Assumption	Transformation
Disease entity	[2]	A closure that fails, or a tension that does not pass on.
Normal value	[42] [55]	The closure of this body at this depth. Not an outside standard.
Body as machine	[44] [45]	Windings in windings. No part is lesser.
Patient as object	[34] [26]	The patient is a mark: also a reader. First-person report is a reading at a depth.
Fixed dose	[15]	A response that depends on the state of the body.
Cure	[48]	Restored closure. Not correction of a defect.

9.2 What changes

Engel asked in 1977 for a model wider than the biomedical one. The definition gives a single language for that width. Body, mind and setting are depths of one closure.

9.3 What stays open

- How a failed closure is read in practice, with what instrument and at what depth.
- How treatment is described when no outside standard is used.

10. Psychology and cognitive science

Psychology measures traits against norms. Cognitive science treats the mind as information processing inside the skull. Both separate the knower from the known.

10.1 Language in use

Word	Assumption	Transformation
Mind inside the head	[52] [53]	A closure of many depths. It does not end at the skin.
Information processing	[17]	Rewrite to closure. A thought is a closure; a question is an open window.
Trait against norm	[42] [55]	A closure pattern of this person. Difference is not defect.
Consciousness outside physics	[39]	The mark is the observer. Distinction and knowing are one act.
Third-person data only	[26]	First person and third person are two readings at different depths.
Ordinary waking state only	[50]	One depth among several.

10.2 What changes

Varela proposed neurophenomenology to bring first-person report back into science. Gibson treated perception as meeting the environment, not as copying it. The definition supports both.

10.3 What stays open

- How first-person and third-person readings are compared at the same depth.
- How capacity is acquired by practice [51] in the language of closure.

11. Linguistics

Linguistics is the field closest to the definition. Saussure wrote that in language there are only differences. That is language built from distinctions.

11.1 Language in use

Word	Assumption	Transformation
Subject and predicate	[28]	A grammatical habit, not a structure of events. Whorf showed that other languages divide events differently.
Word meaning as reference	[2]	A word is a mark. It means by difference from other marks.
True or false sentence	[30]	Closed, open, carried.
Language as code	[38]	A depth of closure among speakers.
Literal versus metaphor	[31]	Lakoff and Johnson show that most abstract speech rests on bodily patterns. In the definition, both are windings.

11.2 What changes

The first sign is in the distinction. The full language is later. Linguistics can therefore study language as a depth of the definition, not as its tool.

11.3 What stays open

- How grammar arises as closure among speakers.
- Whether click languages and other old forms show earlier depths.

12. Computing and information science

Computing rests on the bit: two values. Information theory measures choice among signals. Landauer argued that information is physical [17].

12.1 Language in use

Word	Assumption	Transformation
Bit	—	Trit. Three values with sum zero. Brusentsov's Setun computed in balanced ternary in 1958.
Information as physical	[17]	Reversed. A physical closure is read as an address; matter is not prior.
Program	[13]	A rewrite. The stable result is a fixed point (Result 3).
Simulation as understanding	[24]	A method, declared. Not a test of truth.
Storage	[38]	A closure that persists. Its address is its word.

12.2 What changes

Ternary weights already return in machine learning. The 1.58-bit language-model line uses the alphabet −1, 0, +1. The definition explains why three values are enough: a closure needs no more.

12.3 What stays open

- Whether a machine built on closure, not on stored states, can be specified.
- How the cost of computing is read when energy is not a primary term.

13. Economics

Economics borrowed its central picture from nineteenth-century physics. Mirowski showed that value was modelled on energy and the market on a field in equilibrium.

13.1 Language in use

Word	Assumption	Transformation
Equilibrium	[6] [9]	Closure. A market that clears closes; what does not clear passes on as tension.
Homo economicus	[47] [58]	A closure pattern of persons, not a fixed nature.
Money as measure	[42]	An address of exchange. Not a standard outside the exchange.
Growth	[16]	Movement along the ladders. Doubling and tripling never meet exactly (Result 6).
Elasticity, multiplier	[15]	State functions.

13.2 What changes

If economics loses its borrowed physics, it loses its stage too. Exchange becomes closure between persons. Debt becomes open tension carried to a later depth.

13.3 What stays open

- How cycles in economic records relate to the closure depths 1, 2, 5, 12, 41, 53.
- How a measure without an outside standard is used in accounting.

14. Social sciences

Social sciences start from individuals who exchange signals. Luhmann already built a theory of society on Spencer-Brown. For him, systems are made of communications, not of persons.

14.1 Language in use

Word	Assumption	Transformation
Individual as unit	[52] [53]	A closure that does not end at the skin. Persons share closures.
Society as sum of individuals	[6]	Windings in windings, with tension at the seams.
Norm from outside	[47] [49]	A closure that persists among people. Not a law from elsewhere.
Role, institution	[29]	A recurrent closure.
Deviance	[55]	Another closure pattern, not a defect.

14.2 What changes

Luhmann shows that a social theory can start from the distinction. The definition adds the window of three and depth. A social closure then has a shortest form and an order of scales.

14.3 What stays open

- How the depth of a social closure is read in data.
- How the four relational models of Fiske or similar schemes map to closure types.

15. Depths

Depth is windings in windings. One depth is a factor of three. Depth is therefore read as the logarithm to base three of a ratio.

A ratio needs a reference. This chapter uses the hydrogen atom as depth 0: its radius for length and its orbital period for time. Any other reference shifts all depths by the same amount. Differences between depths do not change.

The values are standard values from physics, biology and astronomy. Each concept gets a length. Where it has a clear own cycle, it also gets a time.

15.1 Depth in length

Concept	Length depth
proton	−10.1
hydrogen atom	0.0
water molecule	1.5
DNA helix (width)	3.3
protein (haemoglobin)	4.2
ribosome	5.6
virus (influenza)	6.9
mitochondrion	9.0
bacterium (E. coli)	9.6
red blood cell	10.9
human cell	11.1
neuron (cell body)	11.7
heart	19.6
human body	22.0
tree	24.6
mountain (Everest)	29.8
Moon	34.6
Earth	35.8
Jupiter	38.0
Sun	40.1
Earth–Sun distance	45.0
Solar System (Neptune orbit)	48.1
nearest star distance	56.3
Milky Way	65.5
observable universe	77.4

15.2 Depth in time

Own cycle	Time depth
Compton period (proton)	−15.8
ground-state orbit (hydrogen atom)	0.0
O–H vibration (water molecule)	3.7
one amino acid added (ribosome)	30.4
division (bacterium (E. coli))	39.6
circulation round (red blood cell)	36.9
cell cycle (human cell)	43.5
spike (neuron (cell body))	26.9
heartbeat (heart)	33.0
breath (human body)	34.4
year (tree)	48.9
month (Moon)	46.5
day (Earth)	43.5
rotation (Jupiter)	42.7
rotation (Sun)	46.4
year (Earth–Sun distance)	48.9
Neptune year (Solar System (Neptune orbit))	53.5
galactic year (Milky Way)	66.4
age of universe (observable universe)	70.1
brain gamma rhythm	29.8
brain alpha rhythm	31.1
human day	43.5
Sun activity cycle	51.1
human life (80 yr)	52.9
precession	58.1
ice-age cycle	59.4
age of Earth	69.1

15.3 A step of eleven in the living range

From the atom to the cell is about 11 depths. From the cell to the body is again about 11. The body sits at 22, twice 11. The proton sits about 10 depths below the atom.

The step of eleven holds from the atom to the body. It does not continue above the body. The Earth sits about 14 depths above the body, the Sun 18.

The cell is the least certain value. A cell of 10 to 30 micrometres gives a depth of 11.1 to 12.1.

15.4 Length and time of the same closure

For each concept with an own cycle, the difference between its time depth and its length depth is computed. The difference counts, in depths, how many returns one own cycle holds, compared with the atom.

Concept	Length	Time	Time − length
proton	−10.1	−15.8	−5.7
hydrogen atom	0.0	0.0	0.0
water molecule	1.5	3.7	2.2
ribosome	5.6	30.4	24.8
bacterium (E. coli)	9.6	39.6	30.0
red blood cell	10.9	36.9	26.0
human cell	11.1	43.5	32.4
neuron (cell body)	11.7	26.9	15.2
heart	19.6	33.0	13.4
human body	22.0	34.4	12.4
tree	24.6	48.9	24.2
Moon	34.6	46.5	11.9
Earth	35.8	43.5	7.7
Jupiter	38.0	42.7	4.7
Sun	40.1	46.4	6.4
Earth–Sun distance	45.0	48.9	3.9
Solar System (Neptune orbit)	48.1	53.5	5.5
Milky Way	65.5	66.4	0.9
observable universe	77.4	70.1	−7.3

Three groups appear.

- Atoms and molecules: a difference of 0 to 2 depths. Their own cycle is close to that of the atom.
- Living closures: a difference of 12 to 32 depths. A cell cycle holds about 32 depths more returns than its size alone gives. The body, the heart and the breath sit at 12 to 13.
- Celestial closures: a difference of 4 to 8 depths. The Milky Way sits at about 1, close to the atom. The universe sits below it, at about −7.

The living range differs from the rest. Living closures hold far more returns per own cycle than atoms and stars do.

15.5 Closure depths

The ladders of two and three nearly meet at the closure depths 1, 2, 5, 12, 41, 53 (Result 6). One value in the tables lies within 0.3 of a closure depth: a human life of 80 years sits at 52.9, next to 53.

15.6 Concepts in order of their making

The concepts of the translation key also have a depth. It is the order in which the definition makes them.

Order	What is made	Concepts
1	One step: with, against or none; sum zero	Direction, the three values
2	The first closure: a window of three	Thing, place, property
3	A full winding, counted	Time, number, identity
4	Windings in windings	Part and whole, level, depth itself
5	Seams between closures	Tension, force, cause
6	One closure reading another	Observer, measurement, information

15.7 Natural units after Larson

Larson takes motion as the only component of the universe. Space and time are its two reciprocal sides. Unit speed is the speed of light.

The natural unit of time is the orbital period of the hydrogen atom: t0 = 1/(2cR) = 1.5198 × 10^−16 s, with R the Rydberg constant. Larson gives 1.5207 × 10^−16 s, a difference of 0.05 per cent. The natural unit of space is the distance at unit speed in that time: s0 = 4.556 × 10^−8 m.

The time depths of 15.2 are therefore already depths in natural units. The length depths shift by one fixed amount: the Bohr radius sits 6.15 depths below s0. In natural units, time minus length counts how many rounds at unit speed one own cycle holds.

Concept	Length (natural)	Time − length (natural)
proton	−16.2	0.4
hydrogen atom	−6.2	6.2
water molecule	−4.6	8.3
ribosome	−0.5	31.0
bacterium (E. coli)	3.4	36.2
red blood cell	4.7	32.2
human cell	4.9	38.6
neuron (cell body)	5.5	21.3
heart	13.5	19.6
human body	15.9	18.5
tree	18.5	30.4
Moon	28.5	18.0
Earth	29.6	13.8
Jupiter	31.8	10.9
Sun	33.9	12.5
Earth–Sun distance	38.8	10.1

Concept	Length (natural)	Time − length (natural)
Solar System (Neptune orbit)	41.9	11.6
Milky Way	59.4	7.0
observable universe	71.2	−1.1

The proton sits at 0.4: its own cycle and its size are at unit speed. The hydrogen atom sits at 6.15, which is the depth of 2π/α. Living closures sit at 18 to 39. The Sun, the Earth and Jupiter sit at 11 to 14; the Moon at 18. The Milky Way sits at 7 and the observable universe at −1, close to unit speed.

15.8 Constants on the ladder

Dimensionless constants are pure ratios. They can be placed on the ladder directly.

Constant	Value	Depth
1/α (fine structure)	137.04	4.48
m_p/m_e	1836.15	6.84
m_n/m_e	1838.68	6.84
m_μ/m_e	206.77	4.85
m_τ/m_e	3477.23	7.42
m_Planck/m_p	1.301e+19	40.06
electric/gravity force p–e	2.269e+39	82.49
s0 / Planck length	2.819e+27	57.53
t0 / Planck time	2.819e+27	57.53
Bohr radius / s0	1.161e-3	−6.15

Three values stand out. The Planck mass sits 40.06 depths above the proton mass, close to a whole depth. The muon–electron mass ratio sits at 4.85, close to the closure depth 5. The natural unit of space sits 57.5 depths above the Planck length, halfway between two depths.

For calibration: with ten values, about two are expected within 0.1 of a whole depth by chance. One is found: the Planck mass.

15.9 Next steps

- Fill the gaps between 11 and 22 and above 22 with more concepts, to see where the step of eleven stops.
- Read each concept with several own cycles. A body has a heartbeat, a breath, a day and a life. Each is a winding at its own depth.
- Test whether the large time difference of living closures is the mark of life in the language of depth.
- Give each unit its pair of depths in space and time, after Larson.
- Write the laws in Grassmann's algebra of directed steps and test which close under the rewrite (Result 3).

16. What recurs

Across eleven fields the same eight moves recur.

- From thing to closure. The primary term is never a substance. It is a return that persists.
- From place to return point. Space is made, not given.
- From time to count. Each closure keeps its own time.
- From cause to tension. What does not close drives the next depth.
- From constant to state. Fixed values are closures that do not vary in the sample.
- From outside standard to own closure. Nothing is measured against a rule from elsewhere.
- From observer to mark. The reader is a distinction too.
- From two values to three. Closed, open, and carried.

The fields differ in how far they already moved. Linguistics, biology after Rosen and Varela, and social theory after Luhmann are close. Physics, medicine and economics carry most of the old language.

Of the five root assumptions in The Assumptions Nobody Declares, the definition removes all five as ground. The outside standard [42] becomes own closure. The subject [28] moves to grammar, after the distinction. Identity in time [29] becomes return. Passive nature [41] becomes closure that selects itself. Nature laid down elsewhere [47] becomes declared ground.

Appendix A. The 58 assumptions and their transformation

Status refers to the definition. R = replaced; L = limiting case; D = dropped; M = method of description, declared; O = open.

#	Assumption	St.	Transformation
1	A world with definite properties exists unobserved	R	Closures exist; the reader is a mark among them.
2	The world consists of things bearing properties	R	Things are closures; properties are ways of closing.
3	What exists is countable or measurable	R	Number comes after the distinction.
4	Explanation runs downward	R	Depth runs both ways; carry goes up.
5	One fundamental level, at the bottom	R	Windings in windings; no bottom required.
6	A whole is parts plus interactions	R	Closure plus tension at the seams.
7	Space is a container	R	Return points.
8	Definite location at every moment	R	Location is made by return.
9	What holds here holds everywhere	L	Holds where a closure does not vary.
10	Symmetry before asymmetry	R	Value differs from its reverse; direction first.
11	Only material and efficient causes	R	Closure selects.
12	A causal chain needs a first term	R	A loop has no first term.
13	Laws are imposed on matter	R	Laws are fixed points of closure.
14	Laws do not change	O	Whether fixed points change with depth.
15	Constants are given	R	State functions.
16	The future does not yet exist	O	A loop has no outside time; open.
17	Information derives from matter	R	Address of a closure.
18	The observer can be removed	R	The observer is the mark.
19	Measurement only registers	R	A reading is a distinction.
20	Theory independent of representation	R	The first sign is in the distinction.
21	The instant state is complete	R	History is shape.
22	Isolate to study	O	Closures share seams; open.
23	Unrepeatable did not happen	R	What does not return passes on.
24	Not simulated, not understood	M	Declared method.
25	Prediction establishes truth	D	Status by derivation.
26	Third person over first person	M	Declared method; both are readings.
27	Complete knowledge is attainable	R	Always a reading at a depth.
28	Every event has a subject	R	Grammar, after the distinction.
29	Identity through time	R	Recurrence of a closure.
30	True or false	M	Description uses two values; the definition has three.

#	Assumption	St.	Transformation
31	Mathematics is the language of nature	R	Language comes from the distinction.
32	The continuum belongs to nature	R	Reading at a depth.
33	Time is one parameter	R	Each closure counts its own returns.
34	The investigator stands outside	R	The investigator is a mark.
35	Perception sets no limits	R	Reading at a stated depth.
36	Imagination is error	O	Not yet treated.
37	Outside world is the object	R	No outside without a seam.
38	Knowledge storable outside the person	O	A closure persists; whether without loss is open.
39	Consciousness outside physics	R	Distinction and knowing are one act.
40	Life is chemistry	R	A closure on its own making.
41	Nature undergoes	R	Closure selects itself.
42	Human measured by outside standard	R	Own closure.
43	Thinkable more real than perceptible	M	Declared method.
44	The body is the lesser part	R	No depth is lesser.
45	The human is composite and ranked	R	Depths are not ranks.
46	Inside, the human is one	O	Not yet treated.
47	What the human is was laid down elsewhere	R	Declared ground; no outside author.
48	Human nature is defective	R	Open tension, not defect.
49	Knowledge comes from outside	R	Knowing is distinguishing.
50	Only waking consciousness knows	R	One depth among several.
51	Capacity is given, not acquired	O	Practice as closure; open.
52	The human ends at the skin	R	Closures do not end at a skin.
53	Contact requires a signal	R	Shared closure.
54	The human stands above the living	R	Depths are not ranks.
55	There is a correct human	R	Other closure, not defect.
56	Consciousness stops with the brain	O	Not decided by the definition.
57	Something acts through the human	O	Depends on reading; open.
58	The human is a finished kind	R	Closure in process.

Totals: replaced 43, limiting case 1, dropped 1, declared method 4, open 9. Total 58.

Appendix B. Status of the statements

- Declared ground: the minimal definition.
- Proved: Results 1 to 8 in Section 1.5, under their stated hypotheses. They are standard mathematics.
- Corresponded: every translation in Chapters 3 to 14 and Appendix A. These are readings.
- Computed: the depths in Chapter 15, from standard values. Script and values are kept with the book.
- Open: every item listed under "What stays open".

No prediction is made in this book.

Annotated References

Each entry gives the source and why it matters for further research.

Konstapel, J. (2026). The Vacuum.Net Theory: Foundations. Ninth Edition, v9.2. Leiden: Constable Research.

Contains full proofs of Results 1 to 8 (Parts III to VII). Its Part I predates the minimal definition used here.

Konstapel, J. (2026). The Assumptions Nobody Declares. Leiden: Constable Research. constable.blog, 26 July 2026.

The list of 58 assumptions used throughout, with the five root assumptions.

Spencer-Brown, G. (1969). Laws of Form. London: Allen & Unwin.

Draw a distinction. The mark, re-entry, and the identity of distinction, mark and observer. The direct precedent of the definition.

Laozi. Tao Te Ching. Trans. D.C. Lau (1963). Harmondsworth: Penguin.

Chapters 1, 2 and 42: the nameless and the named; being and non-being; two produces three.

Kauffman, L.H. (2005). EigenForm. Kybernetes 34(1/2), 129–150.

Forms that reproduce themselves under an operation. Closure as fixed point.

Varela, F.J. (1979). Principles of Biological Autonomy. New York: North Holland.

Extends Spencer-Brown to self-reference and autonomy. Bridge between the mark and living closure.

Maturana, H.R. & Varela, F.J. (1980). Autopoiesis and Cognition. Dordrecht: Reidel.

The organism as a system that produces itself. Supports Chapter 8.

Rosen, R. (1991). Life Itself. New York: Columbia University Press.

Life as closure to efficient causation. Why life is not a case of chemistry.

Luhmann, N. (1984). Soziale Systeme. Frankfurt: Suhrkamp. English: Social Systems (1995), Stanford University Press.

A social theory built on Spencer-Brown's distinction. Supports Chapter 14.

Newton, I. (1687). Philosophiae Naturalis Principia Mathematica. London.

The Scholium on absolute space and time. Source of assumptions [7] and [33].

Leibniz, G.W. & Clarke, S. (1717). The Leibniz–Clarke Correspondence. Ed. H.G. Alexander (1956). Manchester University Press.

The case for relational space and time against Newton.

Mach, E. (1883). Die Mechanik in ihrer Entwickelung. Leipzig: Brockhaus.

Critique of absolute space; inertia as relation.

Barbour, J. (1999). The End of Time. London: Weidenfeld & Nicolson.

Time as derived from change. Close to time as counted return.

Smolin, L. (2013). Time Reborn. Boston: Houghton Mifflin Harcourt.

Argues that laws of nature may evolve. Relevant to assumptions [14] and [15].

Wheeler, J.A. (1990). Information, physics, quantum: the search for links. In W.H. Zurek (ed.), Complexity, Entropy and the Physics of Information. Addison-Wesley.

"It from bit": the observer-participant. A physicist's step towards the mark as observer.

Brouwer, L.E.J. (1908). De onbetrouwbaarheid der logische principes. Tijdschrift voor Wijsbegeerte 2, 152–158.

The first rejection of the excluded middle for infinite domains. Precedent for three-valued closure.

The Univalent Foundations Program (2013). Homotopy Type Theory. Princeton: Institute for Advanced Study.
Identity as a path. Close to identity as return.

Knuth, D.E. (1997). The Art of Computer Programming, Vol. 2, 3rd ed. Reading, MA: Addison-Wesley.
Balanced ternary; truncation equals rounding.

Hardy, G.H. & Wright, E.M. (2008). An Introduction to the Theory of Numbers, 6th ed. Oxford: Oxford University Press.
Kronecker's theorem and continued fractions. Background to Result 6.

Khinchin, A.Ya. (1964). Continued Fractions. Chicago: University of Chicago Press.
Best approximations. Proves that the near-meetings of Result 6 are the convergents of log2 3.

Reidemeister, K. (1927). Elementare Begründung der Knotentheorie. Abh. Math. Sem. Univ. Hamburg 5, 24–32.
The three moves that leave a knot unchanged. Basis of Result 7.

Fox, R.H. & Crowell, R.H. (1963). Introduction to Knot Theory. Boston: Ginn.
Three-colouring of knots. The same rule as the closing window in Result 1.

Jones, V.F.R. (1985). A polynomial invariant for knots via von Neumann algebras. Bull. AMS 12(1), 103–111.
The invariant that shows the first knot differs from its mirror image.

Hopf, H. (1931). Über die Abbildungen der dreidimensionalen Sphäre auf die Kugelfläche. Math. Ann. 104, 637–665.
The winding invariant behind Result 8.

Tiesinga, E., Mohr, P.J., Newell, D.B. & Taylor, B.N. (2021). CODATA recommended values of the fundamental physical constants: 2018. Reviews of Modern Physics 93, 025010.
Source of the atomic and proton values in Chapter 15.

Milo, R. & Phillips, R. (2015). Cell Biology by the Numbers. New York: Garland Science.
Sizes and times of cells, organelles and molecules. Source for the living range in Chapter 15.

Prša, A. et al. (2016). Nominal values for selected solar and planetary quantities: IAU 2015 Resolution B3. Astronomical Journal 152, 41.
Solar and planetary radii used in Chapter 15.

Larson, D.B. (1979). Nothing But Motion. Portland, OR: North Pacific Publishers.
Motion as the only component; space and time as reciprocal sides; unit speed and natural units. Basis of Section 15.7.

Primas, H. (1983). Chemistry, Quantum Mechanics and Reductionism. Berlin: Springer.
Shows that molecular shape is added to, not derived from, quantum mechanics. Supports Chapter 6.

Keller, E.F. (2000). The Century of the Gene. Cambridge, MA: Harvard University Press.
History and critique of the gene as program.

Noble, D. (2006). The Music of Life. Oxford: Oxford University Press.
No privileged level of causation in biology. Supports depth without a bottom.

Canguilhem, G. (1966). Le normal et le pathologique. Paris: PUF. English: The Normal and the Pathological (1989), Zone Books.
The normal as a norm set by the living, not a fact. Supports Chapter 9.

Engel, G.L. (1977). The need for a new medical model: a challenge for biomedicine. Science 196(4286), 129–136.
The biopsychosocial model. A call for the width the definition provides.

Gibson, J.J. (1979). The Ecological Approach to Visual Perception. Boston: Houghton Mifflin.
Perception as meeting the environment. Supports Chapter 10.

Varela, F.J. (1996). Neurophenomenology: a methodological remedy for the hard problem. Journal of Consciousness Studies 3(4), 330–349.
First-person report back into science. Supports Chapter 10.

Saussure, F. de (1916). Cours de linguistique générale. Paris: Payot.
In language there are only differences. Language built from distinctions.

Whorf, B.L. (1956). Language, Thought, and Reality. Ed. J.B. Carroll. Cambridge, MA: MIT Press.
Grammar shapes how events are divided. Supports the subject as grammar [28].

Lakoff, G. & Johnson, M. (1980). Metaphors We Live By. Chicago: University of Chicago Press.
Abstract language rests on bodily patterns.

Landauer, R. (1961). Irreversibility and heat generation in the computing process. IBM Journal of Research and Development 5(3), 183–191.
Information as physical. The view Chapter 12 reverses.

Ma, S. et al. (2024). The era of 1-bit LLMs: all large language models are in 1.58 bits. arXiv:2402.17764.
Neural networks on the alphabet −1, 0, +1.

Mirowski, P. (1989). More Heat than Light. Cambridge: Cambridge University Press.
Economics modelled on nineteenth-century energy physics. Supports Chapter 13.

Kuhn, T.S. (1962). The Structure of Scientific Revolutions. Chicago: University of Chicago Press.
How a field's language holds its assumptions in place. Background to the method.